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Parameterization of the Effects of Unresolved Mesoscale Eddies in Global Ocean Circulation Models.

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For long-term climate simulation applications, ocean general circulation models (OGCMs) that explicitly resolve mesoscale eddy features are computationally prohibitive. For many purposes, horizont al spatial resolutions on the order of $1^\circ \times 1^\circ$ would be adequate, if the effects of unresolved eddies were properly represented. The objective of this project is to develop physics-based subgrid-scale (SGS) parameterizations of mesoscale eddy effects for use in O G CM climate applications. Our approach is to use a statistical two-point turbulence closure approximation (the Direct Interaction Approximation) in conjunction wit h eddy-resolving direct numerical simulation (ERS) to estimate the scaling of subgrid mesoscale eddy transport properties with respect to resolved-scale flow features. We will report on parametric scaling studies of our codes both for the turbulence closure and ERS with a prototypical two-layer quasigeostrophic problem in which mesoscale eddies are driven by a prescribed large-scale field. Results from the parametric scaling studies with the two-layer problem will be used to formulate candidate SGS parameterizations based on the scalings, and the resulting SGS model will be tested in a full OGCM.

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